

What is claimed is:

1. A semiconductor optical modulator comprising
2 at least:
3 a lower cladding layer of a first conductivity
4 type;
5 a light absorption layer which is formed on
6 said lower cladding layer and has a quantum-well
7 structure constituted by a quantum-well layer and a
8 barrier layer; and
9 an upper cladding layer of a second
10 conductivity type formed on said light absorption layer,
11 wherein the quantum-well layer is made of
12 $\text{In}_{1-x-y}\text{Ga}_x\text{Al}_y\text{N}$ ($0 \leq x, y \leq 1, 0 \leq x + y \leq 1$),
13 the barrier layers is made of $\text{In}_{1-x'-y'}\text{Ga}_x'\text{Al}_y'\text{N}$
14 ($0 \leq x', y' \leq 1, 0 \leq x' + y' \leq 1$), and
15 an optical waveguide having a light incident
16 end is constituted by said lower cladding layer, said
17 light absorption layer, and said upper cladding layer.
2. A modulator according to claim 1, wherein said
2 light absorption layer includes a multiple-quantum-well
3 structure.
3. A modulator according to claim 1, wherein said
2 lower cladding layer is formed on a predetermined
3 substrate.

4. A modulator according to claim 1, wherein
2 polarization is produced in said light absorption layer
3 in the absence of a bias.

5. A modulator according to claim 4, wherein the
2 polarization is spontaneous polarization produced in
3 said light absorption layer.

6. A modulator according to claim 4, wherein the
2 polarization is the sum of spontaneous polarization and
3 piezoelectric polarization produced in said light
4 absorption layer.

7. A modulator according to claim 4, wherein the
2 quantum-well layer and the barrier layer have different
3 lattice constants.

8. A modulator according to claim 7, wherein the
2 quantum-well layer has a larger lattice constant than
3 the barrier layer.

9. A modulator according to claim 7, wherein the
2 quantum-well layer has a smaller lattice constant than
3 the barrier layer.

10. A modulator according to claim 4, wherein

2 the quantum-well layer comprises crystal InN,
3 and
4 the barrier layer comprises crystal GaN.

11. A laser with an optical modulator, comprising
2 a waveguide type semiconductor laser and a semiconductor
3 optical modulator which are integrated on a single
4 substrate,

5 wherein said semiconductor optical modulator
6 includes at least a lower cladding layer of a first
7 conductivity type formed on a substrate, a light
8 absorption layer which is formed on the lower cladding
9 layer and has a quantum-well structure constituted by a
10 quantum-well layer and a barrier layer, and an upper
11 cladding layer of a second conductivity type formed on
12 the light absorption layer, the quantum-well layer is
13 made of $\text{In}_{1-x-y}\text{Ga}_x\text{Al}_y\text{N}$ ($0 \leq x, y \leq 1, 0 \leq x + y \leq 1$),
14 the barrier layers is made of $\text{In}_{1-x'-y'}\text{Ga}_x'\text{Al}_{y'}\text{N}$ ($0 \leq x',$
15 $y' \leq 1, 0 \leq x' + y' \leq 1$), and an optical waveguide
16 having a light incident end is constituted by the lower
17 cladding layer, the light absorption layer, and the
18 upper cladding layer.

12. A laser according to claim 11, wherein said
2 optical modulator includes a multiple-quantum-well
3 structure.

13. A laser according to claim 11, wherein
2 polarization is produced in the light absorption layer
3 in the absence of a bias.

14. A laser according to claim 13, wherein the
2 polarization is spontaneous polarization produced in the
3 light absorption layer.

15. A laser according to claim 13, wherein the
2 polarization is the sum of spontaneous polarization and
3 piezoelectric polarization produced in the light
4 absorption layer.

16. A laser according to claim 13, wherein the
2 quantum-well layer and the barrier layer have different
3 lattice constants.

17. A laser according to claim 16, wherein the
2 quantum-well layer has a larger lattice constant than
3 the barrier layer.

18. A laser according to claim 16, wherein the
2 quantum-well layer has a smaller lattice constant than
3 the barrier layer.

19. A laser according to claim 13, wherein
2 the quantum-well layer comprises crystal InN,

3 and

4 the barrier layer comprises crystal GaN.